Potential for use of heat rejected from industry in district heating networks, UK perspective

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UK Indemand
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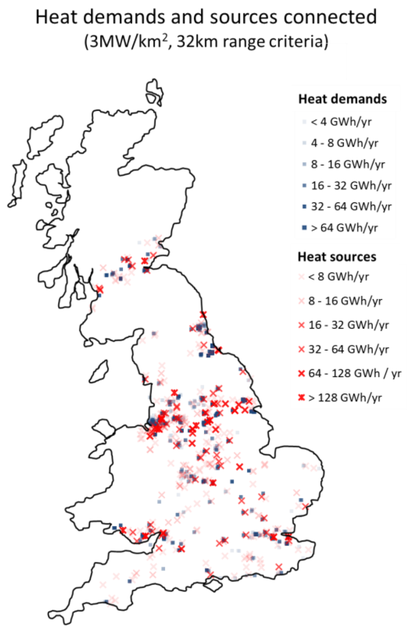
Background

- District Heating Networks (DHN) could act as an enabler for low carbon space heating. In the UK, 4.4 to 6.5 million dwellings and 15.8 to 20.7 TWh/yr of non-domestic space heating demand could be supplied by DHNs[1].
- Waste heat is potentially available from industrial sites across the UK[2].
- ***This study considers the extent to which these heat demands and sources could be connected.***

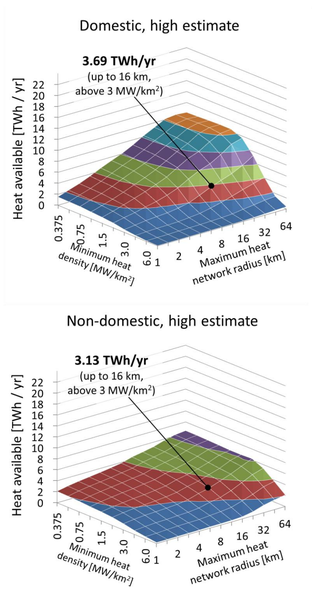
Approach

1. Potential heat rejection from 425 industrial sites (low estimate: 10.1TWh/yr, high estimate: 20.3TWh/yr)[3].
2. Heat demand density across the UK at 1km^2 resolution[4]. (63.1TWh/yr above 3MW/ km^2)
3. Heat available from each site was allocated in turn to nearby demands according to criteria (e.g. distance and heat density of demand) and simple prioritisation.



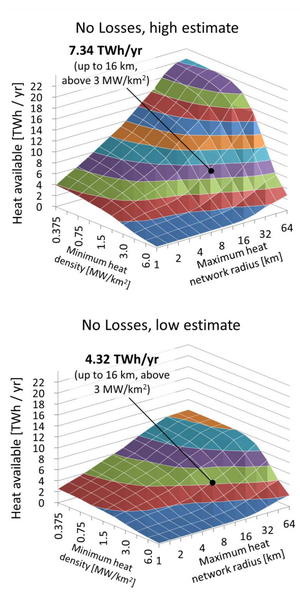
Sensitivities

Domestic / non-domestic



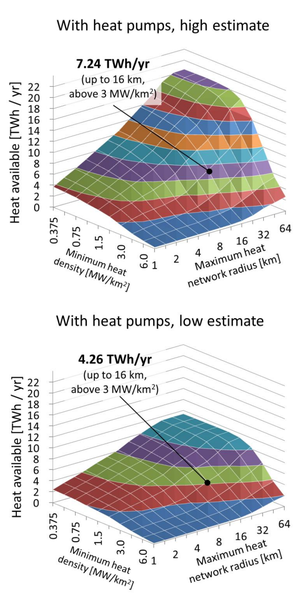
Domestic demands are greater overall but highest heat densities are non-domestic

Effect of removing / doubling heat losses in distribution



For baseline conditions, heat losses have relatively small effect on heat delivered (6-8% change with removing or doubling losses) as available demand is constraint. If relaxed conditions allow longer transmission, the effect of losses increases to around 20%

With heat-driven heat pumps

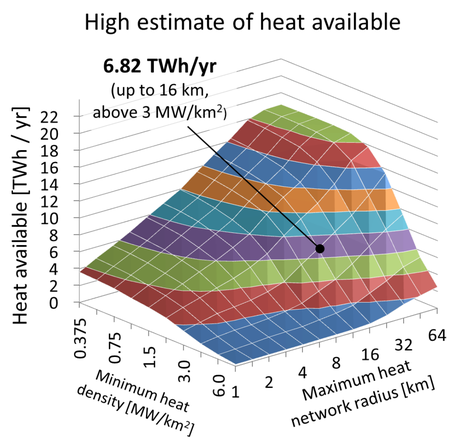


Only 5% increase in overall heat delivered

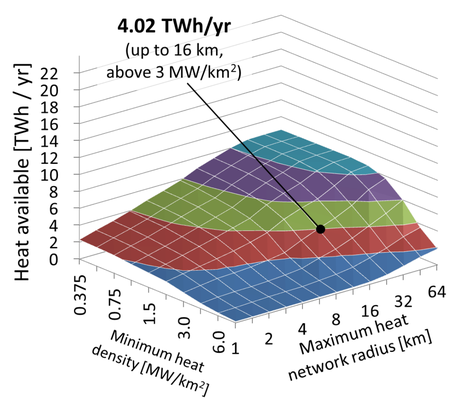
Results

Heat delivered under different maximum distance and minimum density criteria:

High estimate of heat available

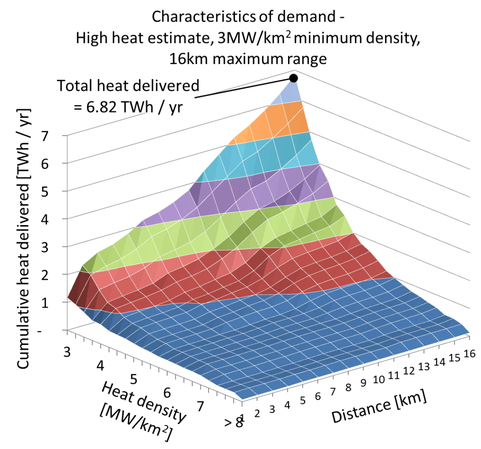


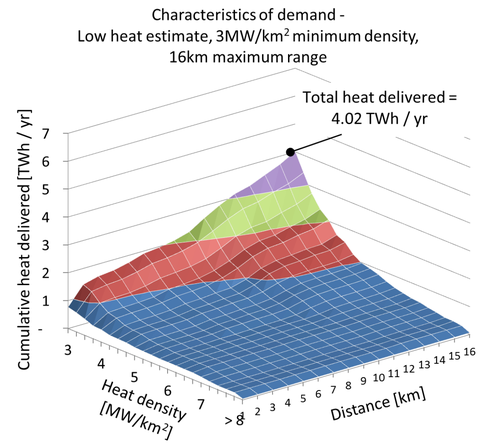
Low estimate of heat available



Heat delivered is insensitive to minimum feasible heat demand densities below 1.5MW/km^2.

Characteristics of demands to which heat is delivered:





High density heat demands are supplied but over half of transfers are to heat densities below 4MW/km^2. A third of the heat supply is accounted for by transfers of less than 2 km but transfers of up to 7 km are needed to account for half of the heat supply

Conclusions

Under the baseline criteria, only 34% to 40% of the heat which is rejected from industrial sites can be used, despite total demands being greater.

In order to use more than 75% of the high-estimate heat resource, the heat would need to be transported up to 45km and include areas with heat demand densities as low as 1.5 MW/km^2.

Thanks to Dr. Simon Taylor for access and interpretation of the DS4DS heat demand database

1. Davies, G., & Woods, P. (2009). *The potential and costs of district heating networks*. Oxford: Poyry Energy (Oxford) Ltd.
2. McKenna, R. C., & Norman, J. B. (2010). Spatial modelling of industrial heat loads and recovery potentials in the UK. *Energy Policy*, *38*(10), 5878–5891.
3. Hammond, G. P., & Norman, J. B. (2014). Heat recovery opportunities in UK industry. *Applied Energy*, *116*, 387–397.
4. Taylor, S. C., Firth, S. K., Wang, C., Allinson, D., Quddus, M., & Smith, P. (2014). Spatial mapping of building energy demand in Great Britain. *Global Change Biology – Bioenergy*, in press.